

**Project Title: Utilizing Yurok Traditional Ecological Knowledge
to Inform Climate Change Priorities**

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Introduction

The Yurok Tribe Environmental Program (YTEP) received a grant in 2012 from the North Pacific Landscape Conservation Cooperative (NPLCC) with partial funding from the Northwest Climate Science Center (NWCSC) to conduct a study entitled, “Utilizing Yurok Traditional Ecological Knowledge to Inform Climate Change Priorities”. This final report summarizes the objectives, methods and results of final analysis of work performed during the project period (October 2012 – March 2014). The report also includes information that may be relevant to other tribes and agencies interested in balancing the cultural and proprietary considerations regarding the collection and use of culturally sensitive Traditional Ecological Knowledge (TEK) and the goals of many tribes to utilize TEK in responding to the issues and needs arising from the impacts of climate change. Key findings have been incorporated into the final recommendations to the NPLCC regarding Yurok tribal science priorities for future research efforts related to the impacts of climate change on habitats, ecosystems and culturally important species of concern.

Background

The Yurok Tribe and the Yurok Reservation are particularly vulnerable to the impacts of climate change due to the location and unique ecosystem that comprise Yurok Ancestral Lands, including the Yurok Reservation. Yurok Ancestral Territory spans multiple micro-climates, including the coastal Redwood-Spruce rainforest of the northwestern California coast and inland to Oak-Madrone forests and prairies. The diversity in ecosystems has provided an abundant diversity of resources for food and other cultural needs for millennia. The Yurok Tribe is very concerned about the potential impacts of climate change on Yurok lands and resources, specifically to culturally significant species and the habitats and ecosystems that support them.

The Yurok Tribe, per its tradition, history and Constitution assert stewardship responsibilities for all resources within their Ancestral Lands. Further, the Yurok Tribe has management responsibilities for all resources within their Reservation Lands. The study area for the project included the 55+ miles of the northern California Coast and inland areas within Yurok Ancestral Lands in addition to the lower 46 miles of Klamath River and the Yurok Reservation. The Yurok Tribe has an interest in the health of the entire Klamath River watershed and the ecosystems that it supports. Some tribal members utilize resource areas that are considered in Aboriginal Territory (areas outside of Yurok Ancestral Territory but traditionally visited for the purpose of procuring specific resources). Included in the study area were: coastal areas, lagoons, the Klamath River and its tributaries, numerous creeks, coastal and inland forests and prairies, and all the wildlife and ecosystems within them. The study area for the Project is identified on the accompanying map.



Figure 1: Map of Yurok Ancestral Territory and Yurok Reservation

The Yurok Reservation extends 1 mile on either side of the lower 46 miles of the Klamath River. The Klamath River is a complex river system that flows from its source in the arid high desert of the eastern Cascade Mountains in Oregon through the Klamath Mountains to the Pacific Ocean. The river supports numerous resident and anadromous species, including Chinook Salmon, Coho Salmon, Pacific Lamprey (eel) and Green Sturgeon. All of these species are of profound importance to Yurok subsistence and culture and remain important foods harvested and relied upon by many Yurok People today. In addition to aquatic resources and species, numerous terrestrial and avian species are also of profound importance to Yurok subsistence and cultural practices.

Climate change models developed for the Pacific Northwest indicate that changes in precipitation will include changes in seasonality, intensity and duration of events (more rain, less snow) (Flint and Flint 2009). Culturally important wildlife: aquatic and anadromous species (salmon, Pacific Lamprey, sturgeon) will have to adapt (or decline) due to the changes in hydrology and temperatures, and will most certainly be impacted by higher intensity rainfall in winter months, lower snowpack and less snowmelt for spring and summer flows in the Klamath River watershed. Further impacts to culturally significant plant and animal species and the unique habitat provided by the redwood coastal forests will likely result from changes in seasonal fog along the redwood coast (Dawson 1998, Johnstone and Dawson 2010). Rising sea levels will have significant impacts on coastal areas, the Klamath estuary and adjacent wetlands that are critical habitat for a number of culturally significant aquatic and terrestrial species.

For these reasons, YTEP began building staff capacity on climate change science in 2008, specifically to train staff on climate change models, understanding potential regional climate change impacts, conducting vulnerability assessments and to initiate adaptation planning for unavoidable and probable climate change impacts to the Yurok Reservation, Yurok Ancestral Territory, the Klamath River and Pacific Ocean. These efforts were initiated due to concerns voiced by the Yurok Tribal Council, many tribal members, the Yurok Tribe's Natural Resources Committee and Culture Committee, and also other tribal departments. Based upon these efforts, YTEP developed the NPLCC TEK project proposal.

The purpose of the Project was to assist the Tribe in collecting and documenting Yurok Traditional Ecological Knowledge (TEK) on ecosystem functions, community structure, species behavior and habitat use. Collecting information on traditional Yurok management approaches that intended to enhance the environmental conditions required for the abundance and successful survival of culturally significant resources and species was also a goal. Another goal was to collect baseline information from tribal elders on conditions and changes in the overall environment and these specific resource communities as observed over their lifetimes. Yurok

TEK provides insights on how these ecosystems should function, indicator species and environmental signals, and identifies the critical components of desirable ecosystems and ecological communities and habitats to support culturally important species. The overall objective was for YTEP to collect and utilize Yurok TEK information to identify priority areas for tribal research, resource management, and adaptation planning to assist the Tribe in responding and adapting/mitigating climate change impacts. It also was intended to serve as a model, utilizing culturally-appropriate ethnographic methods, for tribes and non-tribal entities (such as federal resource managers like the US Fish and Wildlife Service (USFWS) and others) to incorporate TEK in identifying science and management priorities, methods and responses to the complex issues of climate change where mutually beneficial.

Study Objectives

The project had 2 broad objectives. The first objective was to meet the needs of the Yurok Tribe in collecting and documenting TEK to inform tribal planning related to climate change impacts to culturally significant wildlife and habitats that support these species. This information is crucial to informing Yurok Tribe resource managers and the Yurok Council as it embarks on climate change adaptation planning. The Yurok Tribe's Council and Environmental, Forestry, Wildlife, Fisheries and Cultural Resources Programs will benefit from the knowledge and wisdom gained from the project as the Tribe prepares for climate change impacts. The second objective was to assist the NPLCC in its efforts to integrate Tribal TEK into the planning, research and implementation of NPLCC and USFWS goals by providing a model of how to collect and document TEK within a tribal community (while protecting confidentiality and intellectual property rights of the community, elders, and project participants) in a culturally appropriate manner. The methodology utilized was designed to allow for information to be collected, analyzed by YTEP staff, and utilized in order to develop a final summary of recommendations for NPLCC research and science priorities for future climate change efforts.

Study Methods

The project proposal consisted of two phases: TEK data collection and TEK analysis utilizing ethnographic methods. TEK is often a combination of traditional teachings shared between family and community members through verbal transmission (stories told) and observations shared over multiple generations on issues of cultural importance such as subsistence, ceremonial practice, and traditional resource management. It is also often very proprietary, culturally-embedded and privileged information; even within the community. This helps to protect the integrity of the information and wisdom involved and reinforces the responsibility of those who possess, protect and share it. Ethnographic methods were utilized because this is one way to document and record stories, organize and analyze the information contained, and

result in the identification of common themes, key principles, management practices, and priorities that may be shared without compromising or disclosing the specific proprietary, culturally-sensitive information that these stories may contain. While the proposal identified two phases of the project, the reality was that the first step was to navigate the process of protecting culturally-sensitive information, and proprietary and intellectual property rights of the project participants. This required additional time within the Phase 1: Scoping effort. In retrospect, this was the most crucial step in the project and also the most time-consuming to navigate. Without taking the time to navigate these issues identified in the scoping process, and resolve within the Tribal government and with project participants and YTEP staff engaged in the project, the actual completion of the data collection would have been impossible and the project would have been cancelled. This is an important consideration that should be incorporated into any similar efforts. It resulted in some delays in initiating the data collection phase, but resulted in a better process and full-informed consent by all parties. YTEP recommends that any entity wishing to utilize this model for working with TEK take these issues into consideration and allow for time in the project schedule to adequately resolve any Tribal or participant concerns prior to data collection.

Phase 1: Scoping and Protecting Intellectual Property

Scoping sessions were identified as the initial step in the project proposal. Scoping sessions were intended to identify issues or concerns, focus for development of questions to be asked in the structured interviews, and potential project participants. Scoping sessions were proposed as outreach to the Tribal membership and departments, Committees and Yurok Tribal Council to help share information on climate change, causes and probable impacts, issues and concerns specific to the Yurok Tribe. They also were an opportunity to share and discuss what YTEP has been learning and working towards with a grant-by-grant approach to working on this complex issue. Through these meetings the project team was able to derive themes, concerns, anecdotal observations, and priorities to be used in developing questions for the structured interviews. Scoping sessions also were used to identify the appropriate elders who should be asked to participate in the project. One of the goals of the project team was to find participants whose knowledge and expertise spanned the geographic range and resource diversity of Yurok Ancestral Territory. Through these scoping sessions, individual tribal elders, considered to be knowledgeable about specific areas or places, traditions or practices, management strategies, species and habitats, traditional uses and understanding of ecosystems or species, and Yurok cultural practices were identified. The project team contacted these individuals and requested their participation. Some accepted and others declined. A final list of 10 participants were selected and the project team then worked on the Full Informed Consent process, the completion of the contracts and Informed Consent/Use Agreement documents and scheduling of the interviews.

Prior to collection of any data, including the development of the project proposal and also the funding agreement between the NPLCC and the Yurok Tribe, the issues of collection and use of culturally-sensitive information, intellectual property rights, and full, informed consent of the project participants had to be identified, resolved, formalized, and committed to by all parties: the grantor (NPLCC), Yurok Tribe (grantee), and all project participants. These steps are necessary to protect the integrity of the information, the interests and intellectual property rights of the participants and the Yurok Tribe and also to assure that the grantor fully committed to these restrictions on access to primary data collected prior to the Yurok Tribe accepting the grant and committing to complete the project. The project proposal included a “Disclaimer on Data Sharing”:

Traditional Ecological Knowledge (TEK) is considered proprietary information and Tribal intellectual property by the Yurok Tribe. For these reasons several safeguards are built into this project to assure that the rights of the individual participants and the Yurok Tribe are protected at all times with regards to any information collected under this grant. Interview participants will be fully informed of the purpose of the interview by the Project Team and will sign Informed Consent Use Agreements which may include specific instructions or Restrictions on how the data will be used for the project or in the future. All TEK collected data is considered to be the sole property of the Yurok Tribe once collected and any future uses of such data will require express consent of the Yurok Tribal Council and must comply with any specific instructions in the individual Informed Consent Use Agreement signed. All recorded interviews, transcripts, maps and GIS will be kept in a secure location within the Yurok Tribe Environmental Program offices. The TEK data will not be provided to the NPLCC or any outside entity as grant products or deliverables. The final report prepared will be provided to the NPLCC and will be considered the final grant deliverables.

The funding agreement between the Tribe and the NPLCC clearly stated that no primary data collected during the project would be shared outside the Tribe and would not be deliverables on the grant.

The concerns and need to clearly protect the information, the Tribe, project team, and participants were identified in the scoping sessions identified in Phase 1 of the project proposal. It was during the process of identifying project participants for structure interviews that these concerns were raised by Yurok Tribal Council and the members of the Yurok Natural Resources and Cultural Committees. Several months were spent navigating these concerns, working with the Yurok Office of Tribal Attorney to develop contracts, Informed Consent/Use Agreements

and questions to be used in the structured interviews. While a slow process, it was imperative to resolve these issues and concerns prior to the initiation of the data collection process through additional scoping meetings and the structured interviews. The final documents developed and used for the project (contract and Informed Consent/Use Agreements Templates)can be found in Attachment A of this report.

Phase 1: Primary Data Collection – Elder Interviews

The project team worked to incorporate the information gained through the scoping sessions to develop a list of questions for the structured interviews. Once developed these were sent to the selected project participants, along with the contracts and Informed Consent/Use Agreements, in advance of scheduling the interviews so that each participant could review and consider prior to initiating the actual interviews. The interviews were conducted by YTEP Specialist, Joe Hostler, at the homes of the project participants, or at a location agreed to in advance. At the beginning of each interview session, Mr. Hostler, spent time with each participant discussing the project goals and objectives, the questions and completion of the contracts and Informed Consent/Use Agreements. Contracts included a small honorarium (\$100 per participant) for their time to participate in the project. This payment was not for the “purchase” of TEK or information, but rather to compensate the participant for the time they devoted to the completion of the project. This is a standard practice within the Yurok Tribe and the contracts also serve as formal documentation of the project, purpose of the interview, and the intended use of the information by the tribal staff conducting the study. Contracts may also act as a potential legal protection in case of future conflict.

Interviews were audio recorded in their entirety. Maps of Yurok Ancestral Territory were used to help participants identify general areas covered in their interview and were not used for the purpose of identifying specific resource use or cultural use areas. A total of 10 interviews were conducted with 10 Yurok elders. Most interviews lasted 2 or more hours and some required follow up sessions to complete the interview. The questions developed were used to guide the interviews but no participants were asked, or expected, to answer all the questions developed but rather to select the topics and areas that they wanted to cover in their interview. Participants were not asked to disclose culturally-sensitive information during these interviews, but given the topic of climate change and TEK, it was a serious consideration for the audio-recorded interview sessions.

Phase 2: TEK Analysis

Ethnographic methods commonly used in the social sciences were utilized to conduct the TEK analysis of the completed interviews. Each interview was fully transcribed to enable content analysis by the project team. Each interview was indexed specific to themes, geographic areas,

species and habitats, environmental change over time and observed changes in the lifetime of the individual. TEK information was highlighted as it related to the topic of climate change. Due to the free-flowing nature of oral interviews, sometimes the conversations covered topics of interest to the participant, but not necessarily relevant to the topic of climate change. The project team used the content analysis step to filter out information that was not related to climate change and TEK. Once the index was completed, a GIS layer was created. The purpose of the GIS was not to pinpoint or identify specific locations for resource use or cultural use, but to provide a general visual guide on what general geographic areas were covered in each interview. This step was conducted by the project team and used for staff analysis to identify key findings and recommendations for science and research needs and priorities that could be shared with the Tribal Council, Committees, Departments, the NPLCC and the general public in the final report.

Key Findings

While the specific content of each interview is not to be shared in the final report, there are key findings from this project that are relevant to the questions of how to incorporate TEK into climate change research and adaptation efforts. These findings have been developed by the project team and are derived from the information shared through scoping sessions and interviews. There are some common themes that emerged from the content analysis that help frame the recommendations presented in the following section of this report.

1. Yurok TEK is based upon a fundamental principle of respect. Respect for the rights of all beings to exist and the interdependence of humans and the natural world. These core values are at the heart of Yurok ceremonial and cultural practice and also natural resource management. Related to respect is Trust. Knowledge is to be earned and held with great regard, and those wishing to learn Yurok TEK must act trustworthy.
2. Yurok TEK is based upon the active participation of humans in managing the environment for desired outcomes of resource availability and abundance. The relationship between species and humans, species and habitats and the desired abundance and availability of species of cultural importance, be it for food/subsistence, medicines, ceremonial/cultural uses, or economic benefit. Managing for the desired outcomes requires keen observation of ecosystem function, understanding of the inter-relationships and inter-dependence of species and habitats, and actively participating in management practices that will produce the desired outcomes.

3. Numerous species were identified to be in serious decline in recent decades. Specifically, salmon, sturgeon, eels, candlefish, surf fish, shell fish, elk, porcupine, and other important subsistence foods. Much of this decline has occurred in the past 100 years and observed within the lifetimes of the participants.
4. Yurok elders have a good understanding of how the environment has changed over a relatively short period of time (less than 200 years) as a result of the changes in resource use, development, extraction and expansion of the modern industrial age. While not always attributable to climate change, these changes often reflect ecosystem loss and environmental degradation that resulted from the loss of autonomy and self-determination regarding the management of resources, lands, waters and ecosystems within the last 150 years. Additionally elder's experience provides a benchmark of how less disturbed ecosystems should function. There is a keen awareness that colonization, genocide, and other historic impacts that resulted in the loss of sovereignty for many decades resulted in the loss of their ability to manage things as they need to be managed for the benefit of humans and also the species that they share the environment with.

A good example is fire suppression. A traditional Yurok ecological management tool utilized for millennia was the prescribed use of fire. Yurok actively utilized fire as a management tool for the purpose of creating and maintain prairies, providing excellent habitat for elk, deer, grouse and other important plant foods and medicines, as well as quality plants used for traditional basket weavers. This practice continued through the 1930's until it was criminalized. Yurok have watched as the prairies have been encroached upon by Douglas Fir, invasive species and premium habitat has been lost along with the species that it supported. Furthermore, fire suppression resulted in overgrowth of an understory that now threatens the region with the high potential of catastrophic wildfire. Increased wildfire prevalence and severity is an expected and currently observed climate change impact for the Klamath River Watershed. This is an example, while not specific to climate change, that illustrates the changes over time to a specific ecosystem and the cascading negative effects of this type of non-traditional management. It does identify potential areas for environmental and ecological restoration that will help improve overall resiliency of the ecosystem and dependent species which should be incorporated into adaptation planning and implementation projects. The more resilient a community or ecosystem is, the better it will be able to survive climate change impacts in the future.

5. Reciprocity is also a common theme. Humans are as dependent on habitat as the species they support. Humans are not separate from, or more important than the needs of the natural world. Humans and nature have a reciprocal relationship: take care of the earth and it will take care of you. Disrespect it, and you will suffer the adverse consequences. Reciprocity is how one shows respect for the earth and all it provides. The core of Yurok TEK with regards to natural resource management is the principle that management actions should benefit the species, not just the humans. It is long-range thinking as opposed to short-term exploitation purely for economic gain.
6. TEK is retained within the Yurok Tribe primarily due to the diligence of the elders, sharing between the generations, and the careful protection of this information within the community. While the Yurok People can and do share their TEK with the outside world at times, the decision to do so is carefully considered. This is multi-generational knowledge developed over millennia and is highly valued. It is privileged information and access to such information must be earned. It is intellectual property and it belongs primarily to the individual who holds this knowledge but is also a collective responsibility within the Tribe to protect and preserve.
7. TEK is a life way and knowledge is lived through practice.

Study Recommendations to the NPLCC Specific to Climate Change and Science Priorities

General themes based on observed changes over time emerged from these interviews and are areas identified as concerns by the participants. These involve the decrease in the presence, abundance or availability of species, loss of habitats and ecosystems, changes in timing and associations traditionally relied upon to signal the timing of migratory species, and even the complete disappearance of some species. Also the arrival and encroachment of invasive species or diseases in plants that had not previously been observed. Serious concerns about observed changes in Klamath river and tributary flows, temperatures and water quality were expressed. Many remarked on changing seasons, changes in temperature, changes in precipitation associated with specific seasons, loss of fog, the current historic (2014) drought. Everyone had observed gradual and progressive changes over their lifetimes in numerous resources and ecosystems. Community structures have changed and TEK associations signaling the arrival and availability of many foods may no longer work as a result of these changes.

The following summarizes the science research areas or priorities that were a result of this project. This list is not exhaustive, but rather reflects the information gained from the scoping sessions and interviews.

- Changes in Klamath River and tributary water quality. Lower flows, turbid waters, odors, and the appearance of toxic Blue Green Algae are all attributed to human activity and are becoming an increasing issue due to climate change.
- Changes in precipitation and snowpack (quantity, elevation, and timing) are all exacerbating the existing issues impacting Klamath River water quality and the species and people that rely upon it.
- The impacts of both changes in precipitation and temperature, and subsequent impacts on water quality of the Klamath River and tributaries on the larger ecosystem and all the species that rely upon it needs to be studied. Improving conditions where possible is needed (protecting resiliency where possible).
- Impacts of drought and lower precipitation on available surface water for humans and species must be studied. Research and efforts on conservation and protection of cold water refugia, cold water sources is needed.
- Impacts of ocean changes on anadromous and migratory species needs to be studied. Salmon are in decline and the timing of the salmon runs on the Klamath are changing. People are concerned that changing ocean conditions are also impacting these anadromous species.
- Shellfish toxins that result in Paralytic Shellfish Poisoning (PSP) in recent years have been unprecedented and need to be better understood.
- Certain species of fish: salmon, sturgeon, eel, steelhead, and surf fish have all experienced significant declines. Some species such as candlefish and Starry Flounder, traditionally important foods, are reported to be extinct or no longer in the local ecosystem. The causes for these declines need to be better understood.
- Fire ecology and reintroduction of fire as a landscape management tool needs to happen. The benefits to the ecosystem are numerous and are critical to the availability of habitat for elk, deer, grouse and many other foods in addition to medicines and materials used in basketry and other cultural practices. People are aware that one of the consequences of climate change is an increased risk of catastrophic wildfire, which has serious negative impacts on an ecosystem, and many feel that the reintroduction of prescribed burning will actually increase resiliency overall. This should be researched.

- Landscape level impacts need to be better understood. TEK often references the inter-relationship between species within a habitat or ecosystem and everyone observed that this is changing, has changed, and mostly for the worse. Fewer desired species, the arrival of invasive species, loss of food sources, decreases in abundance and availability of subsistence and cultural resources are common concerns.
- Trees, acorns and berries and the species that rely upon them are changing in timing and abundance. Drier winters and hotter summers are impacting these resources and better understanding is needed on the ecosystem needs to help these terrestrial species survive. One example is the arrival and spread of Sudden Oak Death and its impact on Oaks and Tan Oaks (source of acorns used for food). How is this being driven by climate change?
- Plants used for basketry (spruce, alder, hazel, redwood, willow, ferns) and medicines are very important to Yurok People and these are also experiencing changes.
- Changes in fog regime were noted often along with the importance of fog for redwood trees. The decrease in fog over time has the potential to result in the loss of coastal redwood because fog is the primary way redwood takes up water. A better understanding of this relationship is needed.
- Baseline information is needed to monitor change in the future. If you do not know what you have, how will you know how much it is changing?
- Species of Concern Identified in the Interviews include:

Fish/Aquatic: Chinook Salmon, Coho Salmon, Silver Salmon, Steelhead, Green Sturgeon, Pacific Lamprey, Freshwater Mussels, Suckers, Bullhead Trout, Ocean Mussels, Smelt, Surf Fish, Night Fish, Candlefish, Red Perch, Starry Flounder, Clams (all species), Abalone, Dungeness Crab, Sea otters, River otters, Grey Whales, Hake.

Avian/Birds: Mud Hens, Golden Eye Duck, Bufflehead Duck, Canvasback Duck, Grouse, Speckled Robin, Condor,

Terrestrial: Elk, deer, Black bear, porcupine.

Trees/Plants: Coastal Redwood, Coastal Spruce, Alder, Cedar, Madrone, Black Oak, Tan Oak (Laurel), Willow, Hazel, Mushrooms (multiple edible species), Huckleberry, Salmonberry, Thimbleberry, Maidenhair Fern, Deer Brush, Woodwardia Fern, Bear Grass, California Wild Oat.

Conclusion

This project was intended to demonstrate methods that could be duplicated and enable Tribes to protect and utilize TEK in their efforts to work with outside agencies on natural resource management. The Yurok Tribe retains a lot of TEK specific to fisheries needs, fisheries management, forest and land management and wildlife. Because a large number of Yurok tribal members still practice a subsistence based lifestyle and hunt and harvest a lot of their own foods and cultural materials, they utilize TEK as they have been taught by elders and pass it on to the younger generations. TEK may not answer many of the questions that arise when it comes to climate change because what is happening is unprecedented and uncertain. What is known is that things are changing in subtle but complex ways as observed in the decline of species, the changes in timing and availability, and in some cases, the disappearance of important species. What's further known is that Yurok People have survived drastic change throughout thousands of years and are a highly resilient people. Yurok People have lived with and created the landscape through generations of careful practice and accumulated generations of knowledge about their environments. Current and anticipated Impacts and changes to the hydrologic regime are the most significant and have the most dire consequences for Yurok and the ecosystems and species they rely upon and care about. Research is needed on identifying vulnerable and resilient species and ecosystems for the protection and continuation of subsistence foods and culturally important species.

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